Name: ______________________________ Date: ______________

Polynomial Operations SOLUTION (version 128)

1. Let polynomials $p(x)$ and $q(x)$ be defined below.

$$p(x) = x^5 - 2x^4 - 6x^3 + 8x^2 - 5$$

$$q(x) = 8x^5 + 4x^4 - 7x^2 + 9x + 10$$

Express the difference $q(x) - p(x)$ in standard form.

Get "unsimplified" forms. Then find $q(x) - p(x)$ with addition/subtraction.

$$\begin{aligned} p(x) &= (1)x^5 + (-2)x^4 + (-6)x^3 + (8)x^2 + (0)x^1 + (-5)x^0 \\ q(x) &= (8)x^5 + (4)x^4 + (0)x^3 + (-7)x^2 + (9)x^1 + (10)x^0 \\ q(x) - p(x) &= (7)x^5 + (6)x^4 + (6)x^3 + (-15)x^2 + (9)x^1 + (15)x^0 \\ q(x) - p(x) &= 7x^5 + 6x^4 + 6x^3 - 15x^2 + 9x + 15 \end{aligned}$$

2. Let polynomials $a(x)$ and $b(x)$ be defined below.

$$a(x) = 4x^2 + 2x + 3$$

$$b(x) = 6x - 5$$

Express the product $a(x) \cdot b(x)$ in standard form.

You can use a table for multiplication.

*	$4x^2$	$2x$	3
$6x$	$24x^3$	$12x^2$	$18x$
-5	$-20x^2$	$-10x$	-15

$$a(x) \cdot b(x) = 24x^3 + 12x^2 - 20x^2 + 18x - 10x - 15$$

Combine like terms.

$$a(x) \cdot b(x) = 24x^3 - 8x^2 + 8x - 15$$

3. Express $(x + 1)^6$ in standard (expanded) form.

Remember the binomial theorem. It tells us to use Pascal's triangle.

$$x^6 + 6x^5 + 15x^4 + 20x^3 + 15x^2 + 6x + 1$$

Polynomial Operations SOLUTION (version 128)

4. Let polynomials $f(x)$ and $g(x)$ be defined below.

$$\begin{aligned} f(x) &= -2x^3 + 15x^2 + 24x + 21 \\ g(x) &= x - 9 \end{aligned}$$

The quotient of $\frac{f(x)}{g(x)}$ can be expressed as a polynomial, $h(x)$, and a remainder, R (a real number).

$$\frac{f(x)}{g(x)} = h(x) + \frac{R}{x-9}$$

By using synthetic division or long division, express $h(x)$ in standard form, and find the remainder R.

I prefer using synthetic division.

$$\begin{array}{c|cccc} & -2 & 15 & 24 & 21 \\ 9 & & -18 & -27 & -27 \\ \hline & -2 & -3 & -3 & -6 \end{array}$$

So,

$$\frac{f(x)}{g(x)} = -2x^2 - 3x - 3 + \frac{-6}{x-9}$$

In other words, $h(x) = -2x^2 - 3x - 3$ and the remainder is $R = -6$.

5. Let polynomial $f(x)$ still be defined as $f(x) = -2x^3 + 15x^2 + 24x + 21$. Evaluate $f(9)$.

You could do this the hard way.

$$\begin{aligned} f(9) &= (-2)\cdot(9)^3 \ + \ (15)\cdot(9)^2 \ + \ (24)\cdot(9) \ + \ (21) \\ &= (-2)\cdot(729) \ + \ (15)\cdot(81) \ + \ (24)\cdot(9) \ + \ (21) \\ &= (-1458) \ + \ (1215) \ + \ (216) \ + \ (21) \\ &= -6 \end{aligned}$$

Or, if you reference the polynomial remainder theorem, you can state that you know $f(9)$ equals the remainder when $f(x)$ is divided by $x - 9$. Thus, $f(9) = -6$.